machinery may safely be left to the Institutions of Civil and Mechanical Engineers, as well as the consideration of the *applications* of iron and steel. The subject of corrosion is one, however, which, though rather appertaining to the finished product than to its manufacture, is one which should not be altogether overlooked, for if, by any variation in the process of production, the effects of corrosion may be diminished or modified, a new value will be given to the finished product.

There is one thing, however, which, as we hinted at the beginning of this article, has no place in the deliberations of a body holding a scientific position such as the Iron and Steel Institute, and that is the consideration of commercial questions as such and apart from the influence of science upon the cheapening of the cost of production or the lessening of labour. There must be, no doubt, in a society composed to so great an extent of men largely interested in the commercial aspect of the manufacture of iron and steel, a great temptation and tendency for the discussions occasionally to diverge into commercial questions; but it will be the duty of the president for the time being to check such digressions and to keep the discussions within legitimate channels; and it will be one of the objects of the council to allow no paper to come on for reading or discussion which is not calculated to advance the technical and scientific interests of the Institution over which it has been called to preside.

With the present council, and under the presidency of so distinguished a worker in science as Dr. Siemens, there is every prospect of the Iron and Steel Institute keeping up its high scientific character, and we cordially wish it every possible success. C. W. C.

COHN'S BIOLOGY OF PLANTS

Beiträge zur Biologie der Pflanzen. Herausgegeben von Dr. Ferdinand Cohn. Zweiter Band. Erstes Heft. (Breslau, 1876: J. N. Kern.)

THE first part of the second volume of Cohn's Beiträge contains five papers, two of them being illustrated with three plates each. The first paper is by Dr. Leopold Auerbach, "Cell and Nucleus," remarks on Strasburger's work, "Ueber Zellbildung und Zelltheilung." It is a critical paper, and hardly admits of any condensation. He tries to controvert the statements of Strasburger, and sums up thus:—1. The longitudinally striated body in the interior of the cell is not the "nucleus," but the middle part of the so-called "karyolitic figure," and therefore a product of the mixing of the special substance of the nucleus with the surrounding protoplasm; and 2, That the young nuclei do not develop by the fission of the mother nucleus.

The second paper is one of great importance, dealing as it does with one of the carnivorous plants. It is by Dr. A. Fraustadt. "Anatomy of the Vegetative Organs of Dionæa muscipula, Ellis," with three plates. As Dr. Fraustadt gives a very useful summary of results, we may here quote them. Each half of the lamina is slightly bent in a sigmoid manner, and forms a cavity to retain an insect, while the petiole is broadly winged and flattened. The cells of the epidermis, as well as those of the ground tissue, are elongated in the direction of the long axis of the leaf, in the petiole and midrib of the lamina, but in the transverse direction in the rest of the lamina. The cells forming the epidermis contain chlorophyll grains. The epidermis forms numerous stomata and stellate hairs on the upper and lower surface of the petiole, and under-surface of the lamina, but glandular hairs only on the upper surface of the lamina. The glands are placed in depressions in the epidermis, and are formed of a two-celled basal portion, a two-celled short stalk, and a round secreting part of two layers of cells convex on the upper side. The stellate cells are similarly constructed, except that the cells of the top layer grow out in radiating straight arms, giving the whole a star-like appearance. The stellate hairs appear early and are completely developed before the glands begin to form. The stellate hairs and glands are homologous structures. The lamina bears on its margin numerous (from fifteen to twenty) teeth or marginal setæ, and usually six spiny hairs (central setæ) on the upper surface. The marginal setæ are slender, triangular, pyramidal, and have stellate hairs and stomata on all sides. A fibro-vascular bundle is present running nearer the upper than the under side of the structure. Between each of the marginal setæ a single stellate hair is placed sometimes elevated on the top of a small projection, which, however, receives no fibro-vascular bundle. The central setæ consist of two parts, the lower forming a joint, and receiving an axile cellular string; the upper part is conical, contracted below, and has no cellular string. The cells of the central setæ show aggregation of the protoplasm (as described by Darwin in Drosera), as well as those of the glands. In the green parts of the petiole (above ground), and in the midrib of the lamina, the cells of the ground-tissue increase in length and in size of cavity from without inwards, the superficial cells, and those near the fibro-vascular bundles are green, the others colourless. In the lamina, with the exception of the midrib, the inner cells of the ground tissue are colourless, very broad, with sinuous walls and small intercellular spaces. The epidermal cells of the upper side of the lamina and the ground-tissue cells below it, are larger than those of the under side. The chlorophyll grains contain abundance of starch before the leaf has obtained any organic (animal) nourishment. The starch diminished after the reception of organic (animal) matter by the leaves, and lastly disappears entirely from the parts of the plant above ground. The bases of the petioles are dilated into colourless sheath-like portions developed underground and together forming a kind of bulb. The ground tissue consists entirely of equally broad and long cells completely filled with starch, as well before as after the reception and absorption of organic (animal) matter. The starch grains in the part above ground of the petiole and lamina are oval; in the basal sheathing part of the petiole, on the other hand, the grains are cylindrical or rod-like.

The living cells of the lamina and petiole contain a colourless substance dissolved in the cell-sap, precipitated by bases in the form of dark grains which are redissolved by acids. The glands contain no starch. The red colouring matter of the glands becomes converted into green by the action of strong bases as ammonia and potash, but is again restored by the action of acids. The colour seems, therefore, to be identical with the red colouring matter of plants so fully described by Prof. A. H. Church in a recent number of the *Journal* of the Chemical

Society, under the name of Coleine. Colourless glands become coloured artificially after the absorption by the leaves of red-stained albumin. The fibro-vascular bundles, as far as the petiole, are also coloured, thus rendering the absorption very evident. After death black granules form in the tissues of the leaf, visible as black specks on the surface.

In the midrib of the petiole a well-developed axile fibro-vascular bundle runs; from it straight branches proceed into the wings in a "curved veined" manner. The branches split into smaller and smaller twigs, the branching, however, not being symmetrical. In the midrib of the lamina there is a large axile fibro-vascular bundle, which gives off branches (at a right angle) running parallel towards the margin, where they fork and again unite. One bundle formed by the union of the fork-branches runs into each marginal seta of the leaf.

The phloem of the fibro-vascular bundle consists of soft bast; the xylem, in the lamina, chiefly of spiral vessels; in the petiole there are other vessels in addition.

In the youngest leaves the petiole and lamina are not separable. The part first formed, and springing from the flat vegetative cone represents the origin of the lamina, but it remains rudimentary for a long time, during which the petiole is rapidly developing at its base. The lamina at first forms a straight continuation of the stalk, then bending through an angle of 180° bends itself over into the grooved petiole. Afterwards it just reverses the process and straightens itself as it expands.

The margins of the lamina are in the early stages rolled inwards. Afterwards the petiole expands in a plane, and last of all the lamina becomes fully developed.

The stem is short and thick with a ring of xylem. The bundles pass transversely, so that one enters each leaf and each root.

The lateral rootlets are long and strongly developed, but never branch. The cells at the apex are red in colour, the cortical cells become brown in centripetal order and die in as far as the sheath of the fibro-vascular bundle. The vessels develop first at the periphery of the axile bundle, increase in a centripetal direction, and ultimately form an eight-rayed star.

The third paper is by Dr. J. Schroeter, "On the Development and Systematic Position of Tulostoma, Pers." It describes the structure of a very interesting little fungus which passes part of its life below ground, then the stalk elongates, and the open periderm, with a capillitium, appears above ground. The plant described is *Tulostoma pedunculatum*, L. (*T. brumale*, Pers., *T. mammosum*, Fries. Cooke). The sporocarps are developed at a depth of from two to three centimetres below the surface of the ground. They spring from a white, branched, thread-like mycelium, running between grass-roots, and old moss-plants. The mycelium gives rise to fusiform structures of varying thickness, and these pass over by all gradations into true sclerotia. The sclerotia give rise to the sporocarps, but the development was not observed; apparently, however, they bud out from a spot on the surface of the sclerotium. At first the sporocarp is like a small bovista. The spores are developed on remarkable basidia. These form four elongations springing from the sides at unequal heights, and each develops a spore. The basidia only last a short time, and a capillitium is developed in the interior of the peridium, the spores lying between the meshes. Tulostoma has been placed among the Gasteromycetes, in the Lycoperdaceæ, but the peculiar development of the basidia at once separates it from the Lycoperdaceæ, and Schroeter proposes to place it in a new group of the Gasteromycetes, the Tulostomaceæ. The curious genus, Pilacre, seems also to Schroeter to belong to the same division, and he further suggests the possibility of the remarkable genus Batarea being also related.

The fourth paper is one of the highest interest and deals with a most remarkable group of plants. Exceedingly simple in structure, they attack many algæ and water-plants, and seem not unfrequently to have been described as the fruits of algæ by certain algologists. It is by Dr. Leon Nowakowski: "Contributions to the Knowledge of the Chytridiaceæ," and is illustrated by three plates. The genus Chytridium, which gives its name to the group, consists of only one cell. Rhizidium consists of two cells, the lower forming a root-like or branched mycelium-like structure, while Synchytrium consists of a group of cells. Zygochytrium and Tetrachytrium of Sorokine are the most highly developed, and in them the zoosporangia are produced as a branched bearer. Nowakowski describes a new genus, Cladochytrium, in which a branching mycelium is developed in the tissues of the host-plant. Another new genus, Obelidium, has a stalk to the zoosporangium and a well-developed mycelium. The spores of Chytridium are formed by free-cell formation in the zoosporangium, and generally possess a very highly refracting nucleus. The zoospores exhibit, as first pointed out by Schenk, peculiar amœboid modifications of form. The zoospores have only one cilium either before or behind. Conjugation of zoospores has not been observed. When the spores germinate the nucleus gradually disappears and the whole spore either at once grows into a new zoosporangium, or a sort of mycelium is formed. Resting spores have been observed in Chytridia as in Rhizidium, and probably occur in others. The position of these plants is at present doubtful, but probably they are allied to Saprolegnia.

Nowakowski has described certain new forms and carefully-observed forms already described but not fully studied. The following is a synopsis of the forms described:—

I. CHRYTIDIUM, A. Br.

1. *C. destruens*, nov. sp., occurs in cells of a new green gelatinous alga, developing zoospores, and described by Nowakowski under the name of *Chætonema irregulare*.

2. *C. gregarium*, nov. sp., in the ova of a Rotifer; found among the gelatinous matter of *Chætophora endiviæfolia*.

3. *C. macrosporum*, nov. sp., also in the ova of a Rotifer; found among the gelatinous matter of *Chætophora elegans*.

4. *C. coleochaetes*, nov. sp. In the oogonia of *Coleochaete pulviratum*, and never in the vegetable cells.

5. *C. microsporum*, nov. sp., a specimen of *Mastigothrix æruginea*, Ktzg., found in gelatinous matter of *Chætophora elegans*.

6. *C. epithemiæ*, nov. sp., an *Epithemia zebra*, one of the Diatomaceæ.

7. *C. mastigotrichis* nov. sp., a *mastigothrix æruginea*, as in No. 5.

II. OBELIDIUM, nov. gen., Now. The one-celled zoosporangium is elevated on a more or less developed bearer

from the middle of a star-like dichotomously-branched mycelium, which radiates in a single plane. The zoosporangia are separated from the mycelia by a transverse wall. The zoospores are developed in small numbers, and escape by a lateral opening.

1. *O. mucronatum*, nov. sp. In the empty skin of a gnat-larva.

III. RHIZIDIUM, A. Br.

1. *R. mycophilum*, A. Br., is fully described and figured, and the resting-spores traced through their long period of repose.

IV. CLADOCHYTRIUM, nov. gen., Now. The zoosporangia are either developed as intercalar swellings of the one-celled mycelium in the tissue of the host-plant, and separated by transverse walls, or they are terminal at the end of single mycelium threads. The zoosporangia dehisce either by the opening of a long neck, or by a lid. Secondary zoosporangia are developed either in rows or in the interior of old empty zoosporangia.

1. *C. tenue*, nov. sp., in the tissues of *Acorus calamus*, *Iris pseudacorus*, and *Glyceria spectabilis*. Closely related to *Protomyces menyanthis*, De Bary found in the leaves and petioles of *Menyanthes trifoliata*.

2. *C. elegans*, nov. sp., in the gelatinous substance of *Chætophora elegans*.

The last paper is by Prof. Cohn himself—"Remarks on the Organisation of Certain Swarm-Cells." It is chiefly devoted to an account of *Gonium tetras*, A. Br., and certain subjects suggested by the examination of that plant, such as the nature of the "amylum kern," or starch nucleus, the inner organisation of swarm-cells, the cavities and contractile vacuoles in such cells, and the comparison of swarm-cells with one-celled animals. The whole number is one of great interest and will well repay perusal. W. R. MCNAB

OUR BOOK SHELF

Physiography and Physical Geography. By the Rev. Alex. Mackay. (Blackwood and Sons.)

IN his preface the author draws attention "to the peculiar character of the present work," and quotes by way of explanation two paragraphs from the Directory of the Science and Art Department. He remarks that "the student will at once perceive that the author has discussed all the subjects embraced in the new syllabus" of the department. The spirit of this discussion and "the peculiar character of the work" will be best appreciated from a few extracts.

"The combined result of various experiments gives to the earth a density of 5·66 times that of water. But more reliance should be placed on the number indicated by the Great Pyramid, which in this as in so many other great cosmical data, has anticipated modern science by more than 4,000 years." "The sacred volume declares that in the days of Noah the whole world was inundated by a flood, which covered the highest mountains, and that, with the exception of one family, the entire human race was destroyed. A change in the inclination of the earth's axis would certainly produce such a catastrophe—a catastrophe which was accompanied with direful results to all future generations; the alternations of heat and cold became so rapid as to affect the longevity of man, which has from that date gradually shortened from nearly a thousand years to three-score years and ten." "Why the planets move in elliptical orbits" is the title of a paragraph, which, containing no reference to nor explanation of the *ellipticity* of the planetary orbits, is embellished with a diagram to show why the orbits are *circular*. "Mountain-chains of the same geological formation are believed to be of the same antiquity; and, however widely separate, are parallel to one another." "The slow increase in the saltness of the ocean may account for the otherwise inexplicable fact that frequently since the ocean became inhabited, its varied population became wholly or almost wholly extinguished." "The antiquity of the human species as indicated by geological evidence, no doubt conflicts with the chronology of Usher, founded on our modern Hebrew text. In the matter of antediluvian chronology, however, the Hebrew text has, in all probability, been tampered with, as we have shown at large in a separate work ('Facts and Dates,' p. 62-69). The Septuagint translation—a translation sanctioned by our Lord and his Apostles—assigns to our race an antiquity of nearly 1,500 years more than Usher does. Science is giving its emphatic verdict, in this particular, in favour of the Septuagint; and though the extended chronology may fail in meeting all the difficulties of the case, it will certainly meet many of them . . . Geologists are too apt to toy with millions of years as if they were playthings, and to show no regard to moderation or common sense. Science has not hitherto been able to determine the actual antiquity of the planet, and probably never will."

The Book of Algebra. By A. T. Fisher, B.A. (London: Stewart's Local Examination Series, 1877.)

MR. FISHER has aimed at writing a short work on algebra for students who have no intention of reading high mathematics. He has done his task well, and the result is a compact and carefully put together little book. The limit he has set himself is to enable a reader to understand all that is required as preliminary to the solution of higher simultaneous equations; hence we have nothing on the Progressions, Notation, Permutations, &c. On a perusal of the work we have been especially struck with the care taken by the author to bring out a book burdened as little as possible with mistakes. For three-fourths of the book he has been assisted by the printers, but in the chapters on surds, indices, and higher equations we have noticed a plentiful crop of typographical errors. Most of these are, however, easily corrected. There is an unfortunate mistake of + for × twice on p. 47; of − for ÷ in Ex. 14, p. 52.

Some readers would require a larger number of examples; those that are given are, on the whole, very well chosen, and there are some useful problems neatly solved. It is possibly an objection, certainly in the elementary parts, that the answers immediately follow the questions. The book is neatly, and for the most part carefully, printed.

Bulletin of the United States Geological and Geographical Survey of the Territories. Vol. iii. No. 2. (Washington, 1877.)

THE second number of the above *Bulletin* contains three important entomological articles from the pens of Messrs. Osten Sacken, Uhler, and Thorell.

The first memoir, from the pen of that distinguished Dipterist, Baron C. R. Osten Sacken, bears the modest title of "Descriptions of New Genera and Species of Diptera from the Region West of the Mississippi, and especially from California," but he who takes up the paper expecting to find nothing but bare descriptions will be agreeably surprised to find it interspersed with analytical tables of the Diptera of the United States, with diagnoses and critical notes on many species already known, with remarks on their geographical distribution, synonymy, and in fact anything that could in any way contribute towards rendering this order of insects clear of comprehension or attractive to the student.

The second article, by Prof. P. R. Uhler, is a report on the insects collected by himself during the exploration of 1875, including monographs of the hemipterous families *Cydnidæ* and *Saldæ*, and an account of the hemiptera collected by Dr. A. S. Packard, jun. The monograph of